

REMARKS

Applicants appreciate the detailed examination evidenced by the Official Action mailed September 2, 2004 (hereinafter the "Official Action"). In response, Applicants maintain that the pending claims are patentable over the cited art for at least the reasons discussed herein.

Applicants also respectfully note, as discussed herein below in greater detail, that U.S. Patent Application Publication No. 2003-0181053 to Tseng et al. is not prior art as the U.S. filing date of Tseng is later than the foreign priority claimed by the present application. Accordingly, the rejections of Claims 18-24 under § 103 are invalid and should be withdrawn.

Independent Claim 12 is patentable over Applicants own AAPA

Claims 12-17 stand rejected under 35 U.S.C. § 102(e) over what is characterized in the Official Action as Applicants Admitted Prior Art ("AAPA"). *Official Action, page 2*. As discussed herein below in greater detail, the portion of Applicants' disclosure apparently relied by the Official Action represent different approaches noted in the prior art. Accordingly, Applicants respectfully submit that the Official Action appears to be combining different prior art approaches discussed in the background to form the basis of a § 102 rejection, which is improper.

Anticipation under § 102 requires that each and every element of the claim is found in a single prior art reference. *W. L. Gore & Associates Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1554, 220 U.S.P.Q. 303, 313 (Fed. Cir. 1983). Stated another way, all material elements of a claim must be found in one prior art source. *In re Marshall*, 198 U.S.P.Q. 344 (C.C.P.A 1978). "Anticipation under 35 U.S.C. § 102 requires the disclosure in a single piece of prior art of each and every limitation of a claimed invention." *Apple Computer Inc. v. Articulate Systems Inc.* 57 USPQ2d 1057, 1061 (Fed. Cir. 2000). **A finding of anticipation further requires that there must be no difference between the claimed invention and the disclosure of the cited reference as viewed by one of ordinary skill in the art.** See *Scripps Clinic & Research Foundation v. Genentech Inc.*, 927 F.2d 1565, 1576, 18 U.S.P.Q.2d 1001, 1010 (Fed. Cir. 1991). Additionally, the cited

prior art reference must be enabling, thereby placing the allegedly disclosed matter in the possession of the public. In re Brown, 329 F.2d 1006, 1011, 141 U.S.P.Q. 245, 249 (C.C.P.A. 1964). Thus, the prior art reference must adequately describe the claimed invention so that a person of ordinary skill in the art could make and use the invention.

As understood by applicants, the Official Action's discussion of Figures 1 and 2 (*i.e.*, see page 3 of the Official Action) demonstrates that the Official Action is formulating the rejection based on a combination of the different approaches discussed therein. In particular, Figure 1 of Applicants' disclosure shows the effects of oxidation on a gate structure **which is unshielded by an oxygen-diffusion barrier layer**. In contrast, Figure 2 of applicants' disclosure shows an alternative structure in the prior art wherein **an oxygen-diffusion barrier layer is deposited on the entire substrate prior to thermal oxidation of the gate structure**. This is evidenced by Applicants' discussion of Figure 2 in the background section of the disclosure:

Referring to FIG. 2, **steps performed before and after a thermal oxidation process, i.e., a step of forming a gate pattern 90, can be the same as discussed above in reference to FIG. 1. Following formation of the gate pattern 90, a lower insulation layer 28 and an upper insulation layer 30 can be formed to cover an entire surface of the gate pattern 90.** The lower and upper insulation layer 28 and 30 can be made of silicon oxide and silicon nitride, respectively.

The integrated circuit substrate, including the upper insulation layer 30 is thermally oxidized. **The upper insulation layer 30 can provide a diffusion barrier layer that covers an entire surface of the substrate including the gate pattern 90, which can reduce or prevent the amount of oxygen atoms that reach the gate pattern 90 during the thermal oxidation process.** *Application, page 2, lines 13-23.*

As evidenced by the above-cited passage of Applicants' disclosure, the discussion of Figure 2 illustrates that the oxygen-diffusion barrier layer was added to address the negative effects observed using the approach illustrated in Figure 1. Accordingly, it is improper to combine the disclosure of Figure 1 and Figure 2 to formulate the basis of a rejection under § 102, which is the basis of the rejection in the Official Action:

forming a thermal oxidation layer from the oxide layer
beneath the floating gate and on the floating gate between the

oxygen diffusion barrier layer and the floating gate. It is inherent that when a thermal oxidation process is performed on the oxide layer beneath the floating gate and on the floating gate between the oxygen diffusion barrier layer, **curved sides are formed at the two ends of floating gate (Fig. 1) and so a curved side wall portion of the floating gate.** *Official Action, page 3.*

Therefore, as understood by applicants, the Official Action appears to be combining portions of Figure 1 and Figure 2 to provide the evidence used as the basis of the rejection under § 102, which applicants submit is inappropriate under § 102, as **a finding of anticipation further requires that there must be no difference between the claimed invention and the disclosure of the cited reference as viewed by one of ordinary skill in the art,** as discussed above.

Accordingly, applicants respectfully request the withdrawal of the rejection and the allowance of Claim 12. Furthermore, Applicants submit that dependent Claims 13-24 are also patentable for at least the reasons discussed above with reference to independent Claim 12.

Many of the claims which depend from Claim 12 are separately patentable.

In addition to the reasons discussed above in reference to independent Claim 12, many of the dependent claims provide separate bases for patentability over the AAPA. For example, dependent Claim 13 recites in part:

forming an insulating layer on the floating gate and on the substrate beside the gate structure; and
heating the insulating layer and the oxide layer to form the thermal oxidation layer on the substrate beneath the oxygen diffusion barrier layer to provide a pathway in the thermal oxidation layer through the oxygen diffusion barrier layer.

As demonstrated by the above emphasized recitations from Claim 13, the AAPA does not disclose heating the insulating layer and the oxide layer to form a thermal oxidation layer on the substrate beneath the oxygen diffusion barrier layer to provide a pathway in the thermal oxidation layer through the oxygen diffusion barrier layer. In contrast, Figure 2 of the present disclosure shows the upper insulation layer 30 entirely covering the gate structure as well as the substrate adjacent thereto. Accordingly,

applicants respectfully submit that the AAPA does not disclose at least a pathway in the thermal oxidation layer through the oxygen diffusion barrier layer as recited in Claim 13. Accordingly, Claim 13 is separately patentable for at least these additional reasons.

Claim 15 recites in-part: "forming the thermal oxidation layer in an atmosphere **including oxygen atoms that reach silicon atoms included in the floating gate via the pathway in a first amount.**" Applicants respectfully submit that the AAPA does not disclose at least "oxygen atoms that reach silicon atoms included in the floating gate via the pathway in a first amount." Accordingly, Applicants respectfully submit that Claim 15 is separately patentable over the AAPA for at least these additional reasons.

By way of further example, dependent Claim 16 recites in-part: "forming a thermal oxidation layer further comprising forming the thermal oxidation layer in the atmosphere including **oxygen atoms that reach silicon atoms included in the inter-gate dielectric layer via the pathway** in a second amount that is less than the first amount." Applicants respectfully submit that the AAPA does not disclose at least that "oxygen atoms reach silicon atoms included in the inter-gate dielectric layer via the pathway." Accordingly, Applicants respectfully submit that Claim 16 is separately patentable over the AAPA for at least these additional reasons.

Rejection of Claims 24-35 is improper and should be withdrawn as Tseng et al. is not prior art

Claims 24-35 stand rejected under 35 U.S.C. § 103 over the AAPA in view of Tseng U.S. Patent Application Publication No. 2003-0181053 to Tseng et al. ("Tseng").¹ *Official Action, page 5.* As discussed briefly above, Tseng shows a 102(e) filing date in the United States of March 19, 2003. In contrast, Applicants' disclosure claims foreign priority to Korean Application No. 10/2002-0054460, filed September 10, 2002.

Accordingly, the effective filing date of the present application (*i.e.*, September 10, 2002) is earlier than the earliest filing date of Tseng under section 102. Accordingly, Tseng is not prior art, and the rejection of Claims 24-25 based thereon should be withdrawn.

¹ Applicants note that the section in the Official Action detailing the rejection of Claims 25-35 is described as Claims 18-24, not 25-35. Applicants believe that this is a typographical error in the Official Action, and have addressed the rejection of Claims 25-35 as outlined in the detailed discussion section of the Official Action.

Claims 18-24 are non-obvious in view of the AAPA.

Claims 18-24 stand rejected under 35 U.S.C. § 103 over the AAPA. *Official Action, page 4*. In particular, the Official Action basis the rejection on the position that "the selection of such parameters such as energy, concentration, temperature, time, molar fraction, depth, thickness, direction, etc., would have been obvious and involve routine optimization which has been held to be within the level of ordinary skill in the art." *Official Action, page 4*. Applicants respectfully point out that, as discussed above, the AAPA does not disclose what the Official Action alleges, moreover, there is no clear and particular evidence of a motivation or suggestion to modify the AAPA as required under § 103.

To establish a *prima facie* case of obviousness, the prior art reference must teach or suggest all the claim limitations. Furthermore, there must be some suggestion or motivation, either in the reference or in the knowledge generally available to one of ordinary skill in the art, to modify the reference teachings, and there must be a reasonable expectation of success of the combination. The teaching or suggestion to make the claimed subject matter and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure. See MPEP § 2143. As stated by the Court of Appeals for the Federal Circuit, to support modifying a reference in a § 103 rejection, evidence of a suggestion, teaching, or motivation to modify must be clear and particular, and this requirement is not met by merely offering broad, conclusory statements about teachings of references. *In re Dembiczak*, 50 USPQ2.d 1614, 1617 (Fed. Cir. 1999).

Applicants respectfully submit that the above-cited passage of the Official Action (providing the basis of the rejections therein) is not clear and particular and, in fact, provides no evidence of a motivation or suggestion to modify the AAPA. As understood by Applicants, the Official Action appears to base the rejection on the allegation that the recitations of the claims are analogous to those listed and could be similarly changed (and therefore are obvious).

Applicants respectfully submit that whether parameters could be changed is not the standard for rejection under § 103. In other words, the fact that certain parameters could be changed does not render those changes obvious. Accordingly, Applicants respectfully request if the Examiner maintains the rejection of these claims under § 103

over the AAPA, that the Examiner specifically point to portions of the AAPA that provide the clear and particular evidence required of a rejection under § 103.

Furthermore, the Official Action appears to be ignoring that the claims recite structures that are formed as a result of the unique pathway claimed by the applicants. For example, in some embodiments according to the invention as illustrated for example in Figure 7, the pathway B allows oxygen to pass to the floating gate and thereby cause oxidation (during the thermal oxidation process) to a greater degree close to the oxide layer 110 and to a lesser degree at the upper surface of the floating gate electrode as well as on a lower surface of the control gate 142. In contrast, the AAPA relied on by the Official Action for the motivation or suggestion to modify Figures 1 and 2 show two very different structures including different side wall profiles of the gate structures therein. For example, the gate structure in Figure 1 shows curved side walls each having about the same profile on both sides of both the floating gate as well as the control gate. Figure 2 shows that the control gate and the floating gate have "squared off" rather than rounded edges which is promoted by the oxygen diffusion barrier layer 30. Accordingly, there is no motivation or suggestion in the AAPA (such as Figures 1 and 2) to somehow modify these structures to provide different degrees of curvature not only the control and floating gates but for different surfaces within each of the floating and control gates. Applicants respectfully submit this is further evidence that there is no clear and particular evidence of motivation or suggestion to modify the AAPA as required under § 103.

Applicants respectfully submit that Claims 18-24 are patentable over the AAPA for at least the reasons discussed above and respectfully request the withdrawal of the rejections of Claims 18-24.

New Claim 36 is patentable.

Applicant has added new independent Claim 36 which recites in-part:

forming a gate structure including a floating gate on an oxide layer on a substrate;

forming an oxygen diffusion barrier layer **on a side wall of the gate structure above and on the oxide layer**; and

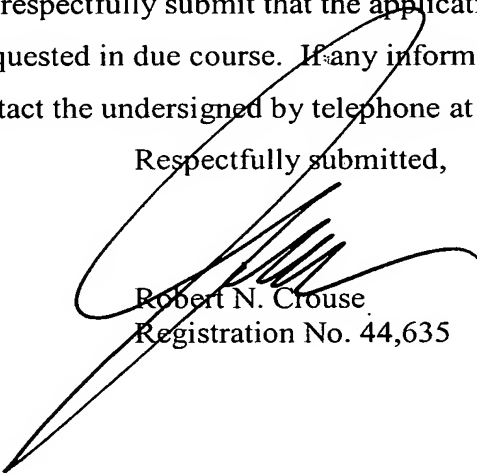
forming a thermal oxidation layer from the oxide layer beneath the floating gate and on the floating gate between the oxygen diffusion barrier layer and the floating gate to define a curved side wall portion of the floating gate.

As shown above, the oxygen diffusion barrier layer is formed on a side wall of the gate structure above and on the oxide layer. In contrast, Figure 2 of the AAPA shows that the oxygen diffusion barrier layer 30 is not on the oxide layer 12. Accordingly, applicants respectfully submit that new independent Claim 36 is patentable for at least these reasons.

CONCLUSION

Applicants have shown that independent Claim 12 and the claims which depend therefrom are patentable over the AAPA. Furthermore, Applicants have shown that there is no motivation or suggestion to modify the AAPA as required under § 103. Applicants have further shown that Tseng is not prior art and the rejections based thereon should be withdrawn. Therefore, Applicants respectfully submit that the application is condition for allowance which is respectfully requested in due course. If any informal matters arise, the Examiner is encouraged to contact the undersigned by telephone at (919) 854-1400.

Respectfully submitted,

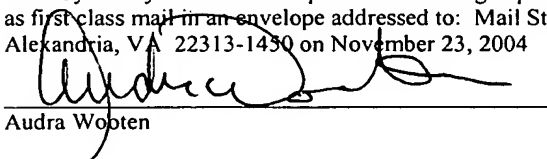


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